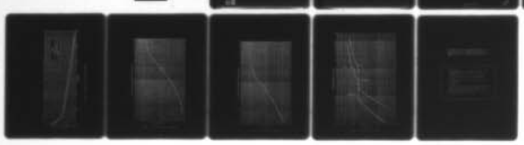
AD-A044 662 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MISS F/G 8/3
DAUPHIN ISLAND LITTORAL TRANSPORT CALCULATIONS.(U)
SEP 77 A W GARCIA
UNCLASSIFIED WES-MP-H-77-11 NL

1 OF 1
AD
A044662



END
DATE
FILMED
10-77
DDC

2

MISCELLANEOUS PAPER H-77-11

DAUPHIN ISLAND LITTORAL TRANSPORT CALCULATIONS

by

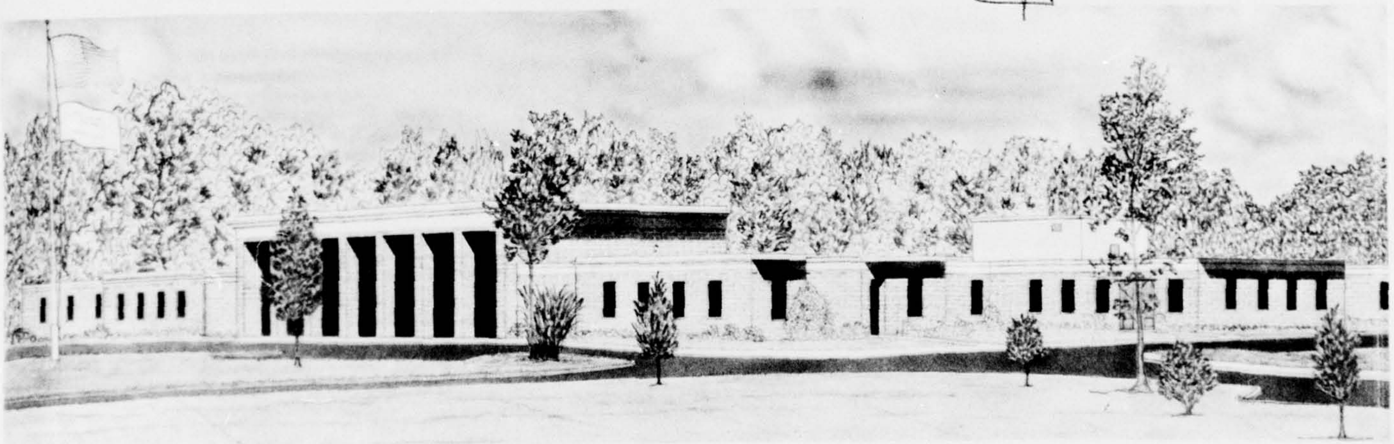
Andrew W. Garcia

Hydraulics Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

September 1977

Final Report

Approved For Public Release; Distribution Unlimited



Prepared for U. S. Army Engineer District, Mobile
Mobile, Alabama 36628

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Miscellaneous Paper H-77-11	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER 9
4. TITLE (and Subtitle) 6 DAUPHIN ISLAND LITTORAL TRANSPORT CALCULATIONS		5. TYPE OF REPORT & PERIOD COVERED Final Report, 6. PERFORMING ORG. REPORT NUMBER Mar-Apr 77
7. AUTHOR(s) 10 Andrew W. Garcia		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineer Waterways Experiment Station Hydraulics Laboratory P. O. Box 631, Vicksburg, Mississippi 39180		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 11
11. CONTROLLING OFFICE NAME AND ADDRESS U. S. Army Engineer District, Mobile P. O. Box 2288 Mobile, AL 36628		12. REPORT DATE September 1977 13. NUMBER OF PAGES 12
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 14 WES-MP-H-77-11		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

12 16p.

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dauphin Island
Littoral drift
Mathematical models
Sediment transport

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Computations of annual gross and net littoral transport seaward of the breaker zone are made for the area offshore Dauphin Island, Alabama by means of a numerical model. Forty-four combinations of significant wave height and period are considered but only two deep water wave directions; waves approaching at angles of forty-five and one hundred thirty-five degrees relative to the shoreline. Results are presented in tabular and graphic form.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

038100

AB

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

PREFACE

The study described herein was performed in response to a telephone request by the Planning Division, Mobile District (SAM), on 2 February 1977. The study was authorized on 17 February 1977.

The study was conducted during the months of March and April 1977 by the Wave Dynamics Division, Hydraulics Laboratory, Waterways Experiment Station (WES), under the direction of Mr. H. B. Simmons, Chief of the Hydraulics Laboratory, and Dr. R. W. Whalin, Chief of the Wave Dynamics Division. The bulk of the computations as well as various aspects of the programming involved were performed by Mr. James Ethridge, Civil Engineering Technician. The study was supervised and this report prepared by Mr. A. W. Garcia, Research Oceanographer. Mr. Earl Howard, Planning Division, SAM, provided the wave, sediment and bathymetric data used in performing the computations.

Commander and Director of WES during the performance of this study and preparation of the report was COL John L. Cannon. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
miles (U. S. statute)	1.609344	kilometres
cubic yards	0.7645549	cubic metres
pounds (mass) per cubic foot	16.018546	kilograms per cubic metre
square feet per second	0.09290304	square metres per second
degrees (angle)	0.01745329	radians

DAUPHIN ISLAND LITTORAL TRANSPORT CALCULATIONS

Introduction

1. Dauphin Island is located just westward of the mouth of Mobile Bay, Alabama. It is an elongated sand barrier island approximately 14.5 miles long and 0.5 miles wide. The bathymetry south of Dauphin Island is characterized by an extremely flat, shallow shelf (Figure 1) extending seaward for about 38 miles (20 fathom isobath). The slope is very gradual, enough so that along a transect the change in water depth can be less than 30 ft in five miles. This broad flat bottom results in significant frictional dissipation of wave energy accompanied by a substantial decrease in wave height as waves traverse this shelf. For particular wave conditions (period, deepwater height, angle of approach, etc.), this frictional dissipation may result in the wave height at breaking being less than the deepwater wave height.

2. The values of littoral sediment transport presented herein were computed using the methodology described in Reference 1. The wave data used were taken from SSMO publications and the wave directions were grouped into three octants; 112.5° to 157.5°; 157.5° to 202.5° and 202.5° to 247.5°. The mean compass angles for each of these octants was therefore 135°, 180°, and 225°, respectively. Because the shoreline in the vicinity of interest extends directly east-west, the waves grouped into the second directional octant (180°) make no contribution to the littoral transport. The remaining directional octants have deepwater wave directions of 45° relative to the shoreline. Because the computational model is very sensitive to changes in deepwater wave direction, the grouping of waves into only two directions of approach undoubtedly introduces a significant source of error.

3. To adequately represent the radical change in bottom slope at about the 25-ft isobath (slope changes from approximately 1/100 to 1/1000 as one proceeds seaward), the execution of the model was initiated with a 60-ft maximum depth and bottom slope of 0.0011363 and stepped shoreward in 1,000-ft increments until the depth reached 25 ft. Execution was halted and the bottom slope changed to 0.0113636. Execution was then resumed

with a 50-ft step size until the wave broke. A comparison of the prototype and model bottom profiles is shown in Figure 1.

Results

4. Table 1 gives the volume of sediment transported within distance intervals. Each calculated volume is assumed to be distributed in the interval between the corresponding distance and the subsequent (numerically smaller) distance. For example, the gross transport of 382 $yd^3/yr/ft$ is assumed to be distributed over the distance interval between 34,200 ft and 33,200 ft. Figures 2 and 3 show the integrated (cummulative) gross and net transports respectively. These figures respectively display the total calculated transport between the indicated water depth (abscissa) and 60 ft. For example, the total gross transport (Figure 2) between 30 and 60 ft water depth would be about 21,000 $yd^3/yr/ft$. The total net transport (Figure 3) would be about 6,700 $yd^3/yr/ft$. Figure 4 shows the net and gross transport gradient. For example, the gross annual transport over a 100-ft interval (normal to the shoreline) centered at 30 ft water depth would be about 145 $yd^3/yr/ft$ (100 x 1.45). The corresponding net transport would be about 54 $yd^3/yr/ft$ (100 x .54).

Concluding Remarks

5. There is the ever present temptation when applying a fairly rigorous mathematical treatment to a data set to feel that the final calculations are somehow "better" or more reliable than the initial information. The results presented herein are particularly susceptible to such a temptation. Therefore, when using these calculations, one should keep in mind that they represent only a first order approximation to the values of the littoral transport in the specified area and should be treated as such until field verification measurements can be made.

6. Gorsline (Ref. 2) estimates a <u>total</u> net littoral transport at Gulf Shores, Florida, of 196,000 yd^3/yr (150,000 M^3/yr). Gulf Shores is located approximately 45 miles east of Dauphin Island and exhibits an offshore morphology similar to Dauphin Island. Assuming the total net littoral drift is

about the same at Dauphin Island, the total net littoral transport seaward of the breaker zone of 27,437 $yd^3/yr/ft$, or about 1/7 of the total net littoral transport, appears reasonable.

REFERENCES

1. Garcia, A. W., and F. C. Perry, "A Means of Predicting Littoral Sediment Transport Seaward of the Breaker Zone," TR-H-76-13, USAE Waterways Experiment Station, Oct 1976, Vicksburg, Miss.

2. Gorsline, D. S., "Dynamic Characteristics of West Florida Gulf Coast Beaches," Marine Geology, Vol. 4, pp 187-206, 1966.

Table 1

DISTANCE FROM BEACH (FT)	MODEL WATER DEPTH (FT)	VOLUME SE QUAD (CU YDS/YR/FT)	VOLUME SW QUAD (CU YDS/YR/FT)	GROSS (CU YDS/YR/FT)	NET (WESTWARD) (CU YDS/YR/FT)
34200.0		235.42	146.57	381.99	88.85
33200.0	(60.2)	245.37	151.27	396.64	94.09
32200.0		254.85	155.97	410.82	98.89
31200.0		264.73	160.85	425.59	103.88
30200.0		274.99	165.88	440.86	109.11
29200.0	(55.7)	285.54	171.02	456.57	114.52
28200.0		296.59	176.38	472.97	120.20
27200.0		310.96	182.84	493.80	128.13
26200.0		323.87	188.86	512.73	135.01
25200.0		337.32	195.12	532.44	142.19
24200.0	(50.0)	351.45	201.67	553.13	149.78
23200.0		366.50	208.69	575.19	157.80
22200.0		388.09	217.18	605.27	170.90
21200.0		405.89	225.02	630.91	180.87
20200.0	(45.5)	424.40	233.15	657.55	191.25
19200.0		455.72	245.38	701.11	210.34
18200.0		479.44	255.32	734.76	224.12
17200.0		504.75	265.86	770.61	238.90
16200.0	(40.9)	531.95	277.11	809.06	254.84
15200.0		561.25	289.10	850.35	272.15
14200.0		591.84	301.61	893.46	290.23
13200.0		624.30	314.82	939.12	309.48
12200.0		659.82	329.10	988.91	330.72
11200.0	(35.2)	698.65	344.57	1043.22	354.07
10200.0		769.28	361.21	1130.49	408.06
9200.0		820.59	378.23	1198.82	442.36
8200.0		875.69	396.16	1271.84	479.53
7200.0	(30.7)	943.03	417.64	1360.67	525.39
6200.0		1014.55	440.18	1454.73	574.36
5200.0		1089.32	463.60	1552.93	625.72
4200.0		1170.89	489.07	1659.96	681.81
3200.0		1259.68	516.88	1776.56	742.80
2200.0	(25.0)	336.90	190.90	527.80	146.00
2150.0		370.76	210.79	581.55	159.97
2100.0		409.18	233.51	642.69	175.67
2050.0		453.05	259.61	712.66	193.45
2000.0		506.14	290.54	796.68	215.60
1950.0		564.79	325.58	890.37	239.22
1900.0		632.69	366.31	999.00	266.38
1850.0		711.59	413.82	1125.41	297.76
1800.0		803.62	469.43	1273.06	334.19
1750.0	(20.0)	911.64	534.92	1446.55	376.72
1700.0		1039.01	612.40	1651.41	426.62
1650.0		1190.17	704.61	1894.78	485.56
1600.0		1370.13	814.96	2185.09	555.17
1550.0		1599.28	951.78	2551.06	647.50
1500.0		1864.65	1113.93	2978.59	750.72
1450.0		2187.70	1311.59	3499.29	876.11
1400.0		2583.68	1554.17	4137.85	1029.51
1350.0		3073.03	1854.23	4927.25	1218.80
1300.0	(14.8)	3682.77	2228.37	5911.14	1454.40
1250.0		4448.61	2698.81	7147.42	1749.81
1200.0		3730.11	1841.31	5571.42	1888.79
1150.0		4165.38	1910.07	6075.45	2255.31
1100.0	(12.5)	4762.62	2027.57	6790.19	2735.05
		59215.	31786.	91001.	27429.

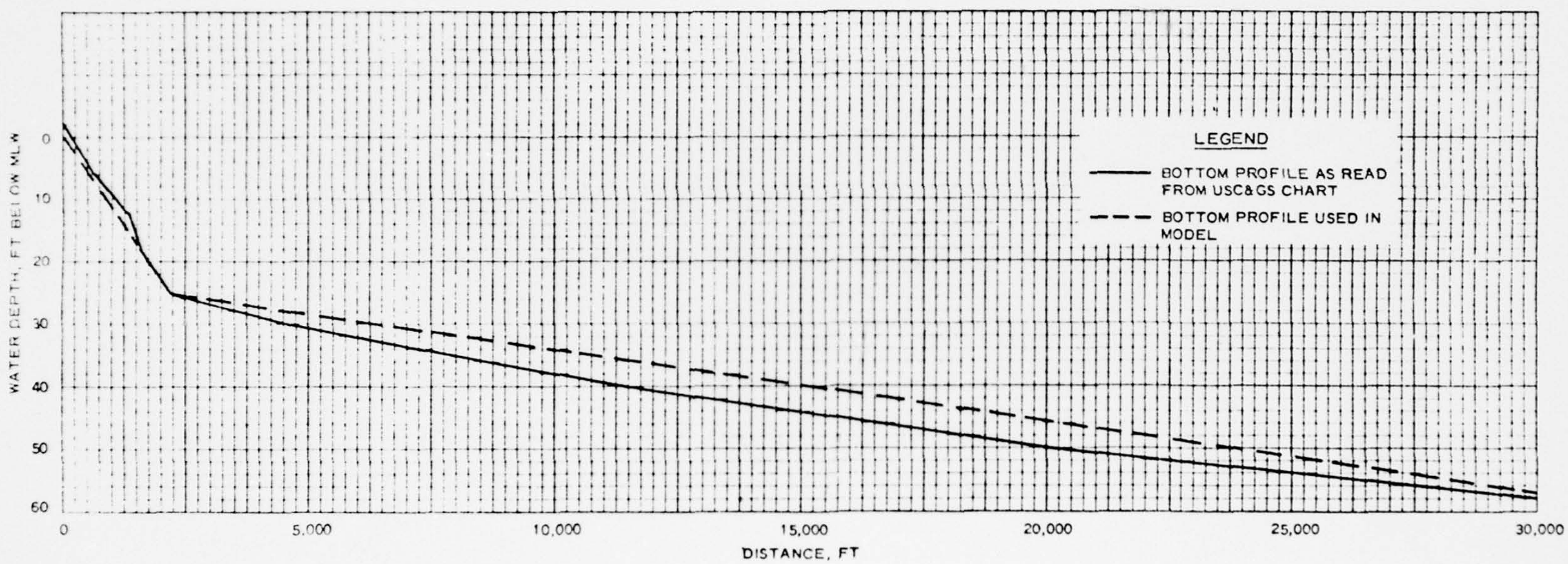


Figure 1. Comparison of bottom profiles.

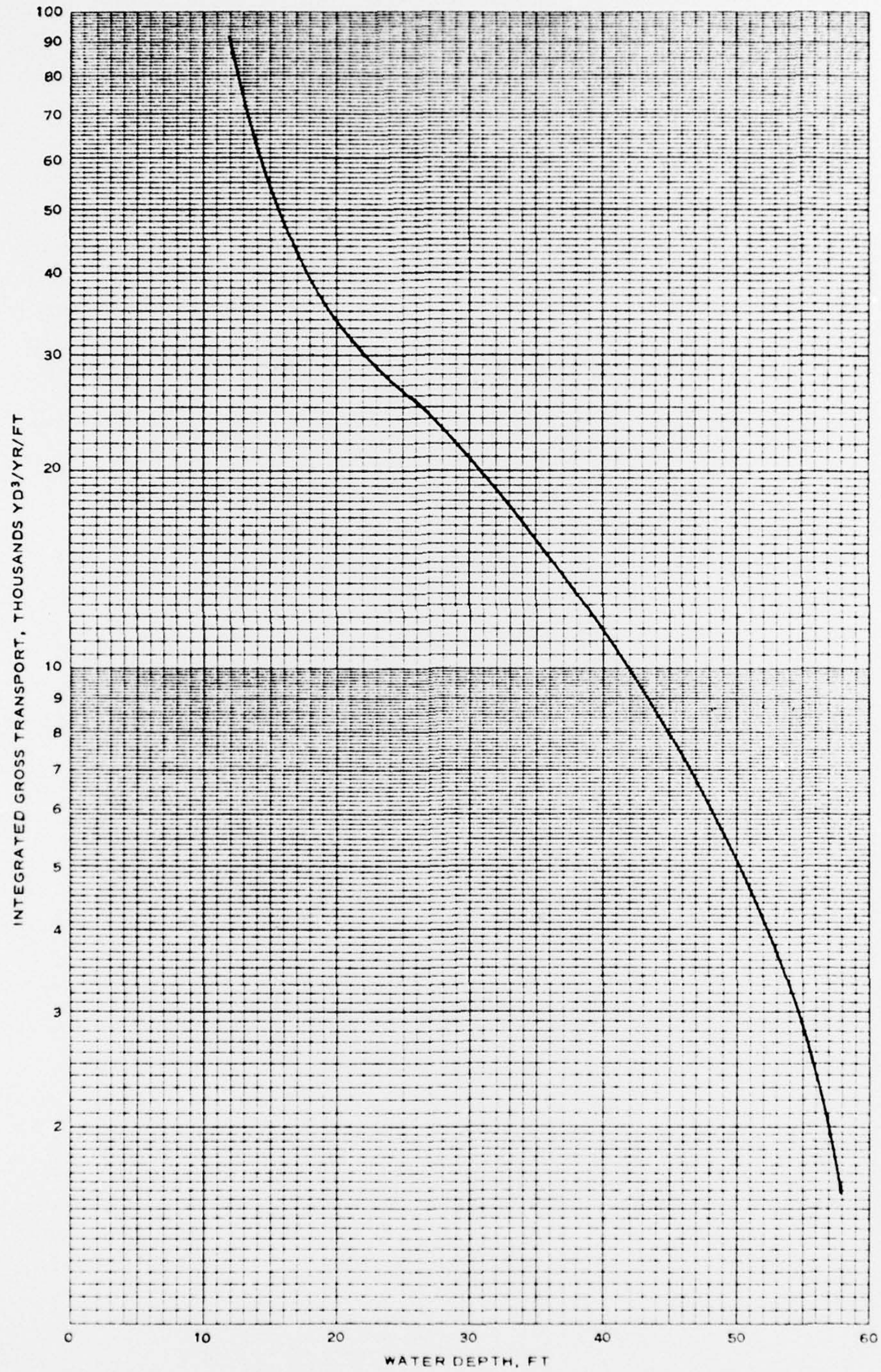


Figure 2. Integrated gross transport.

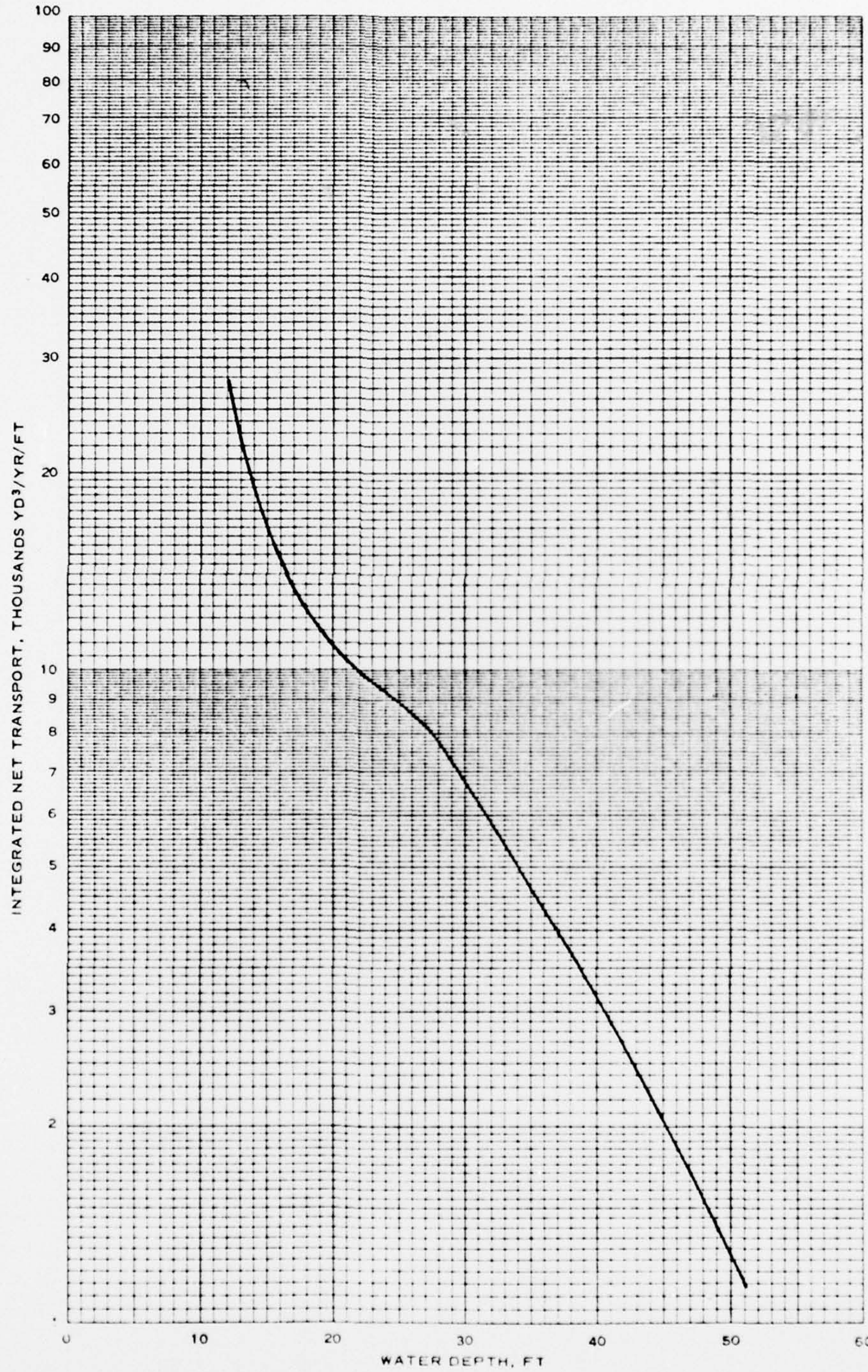


Figure 5. Integrated net transport.

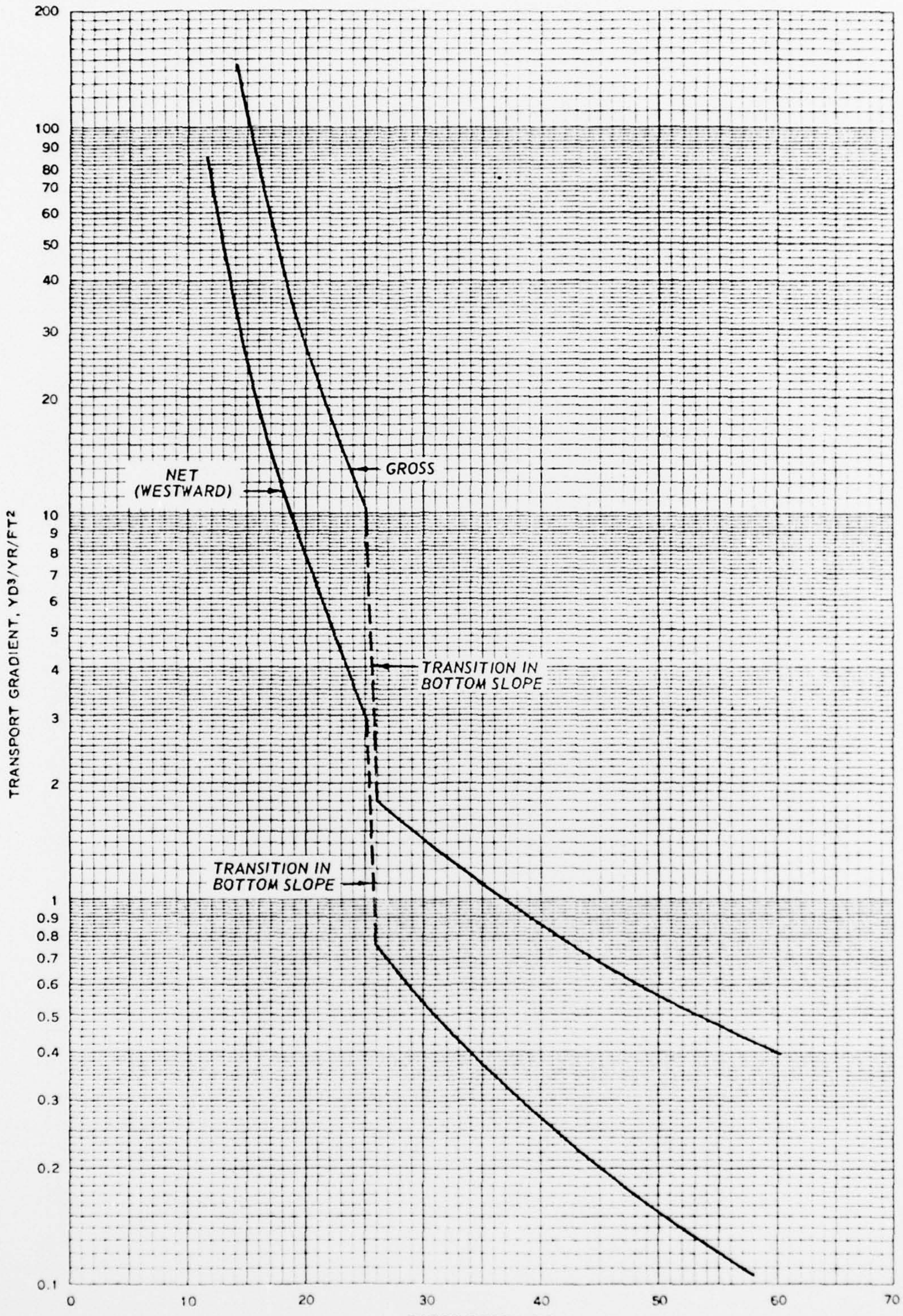


Figure 4. Transport gradients.

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Garcia, Andrew W

Dauphin Island littoral transport calculations / by Andrew W. Garcia. Vicksburg, Miss. : U. S. Waterways Experiment Station, 1977.

7, [5] p. : ill. ; 27 cm. (Miscellaneous paper - U. S. Army Engineer Waterways Experiment Station ; H-77-11)

Prepared for U. S. Army Engineer District, Mobile, Mobile, Alabama.

References: p. 7.

1. Dauphin Island. 2. Littoral drift. 3. Mathematical models. 4. Sediment transport. I. United States. Army. Corps of Engineers. Mobile District. II. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Miscellaneous paper ; H-77-11.

TA7.W34m no.H-77-11